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The Agricultural College

EXTENSION BULLETIN

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CORN CULTURE

By WILLIARD H. DARST,
Assistant in Agronomy.

But let the good old crop adorn
The hills our fathers trod;
Still let us, for his golden corn,
Send up our thanks to God!
—Whittier.

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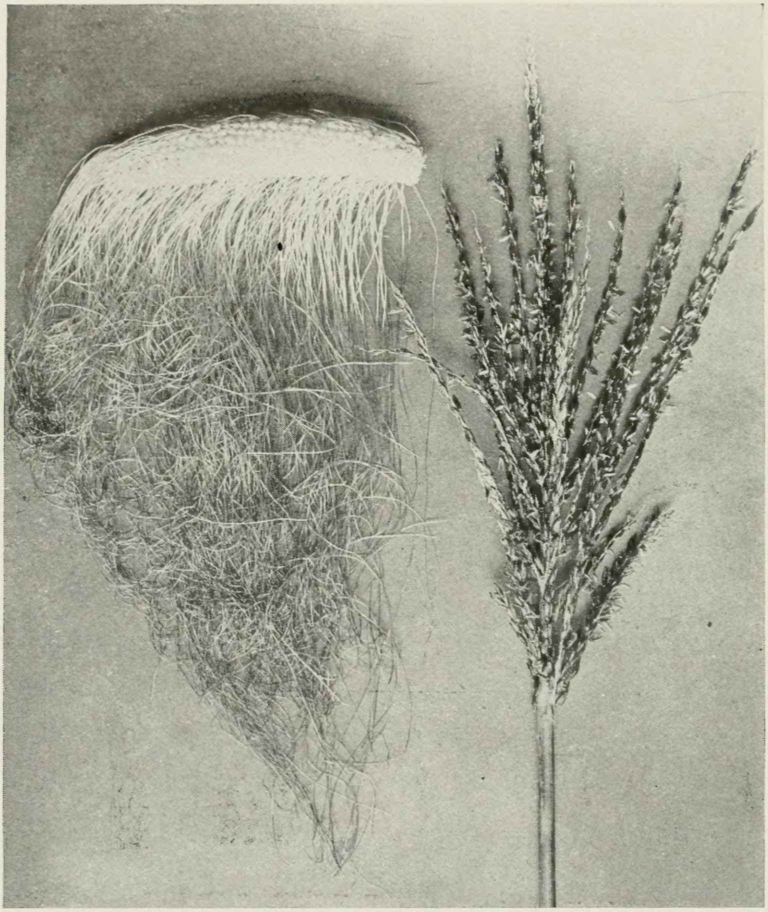


Courtesy of Iowa State College.

The tassel and the developing ear of corn. Before the grain can develop, its particular thread of silk must receive a particle of dust pollen from the tassel.

CORN CULTURE

By W. H. DARST

The average production of corn in the United States during the past ten years has been about 26 bushels per acre. From the best estimates, it is concluded that half of those now producing corn in this country are harvesting less than 26 bushels per acre, a fact which few farmers would care to acknowledge. They know that growing corn at such low yields results in financial loss. Twice 26 bushels is a fair crop, three times that quantity is a good crop, and four times, or a little over one hundred bushels per acre, is frequently produced.

The yield per acre in the New England States with their older soils and shorter seasons is greater than in any other part of the country. Since the average crop in the states best adapted to corn growing is but little above the general average of the entire country, it is evident that the average is not lowered to any extent by the poorer crops in sections unsuited to corn growing. These facts clearly indicate the possibility of greatly increasing the yield per acre, especially in the corn belt.

SOIL

A clay or silt loam is the typical corn soil. These soils are found for the most part in the glacial drift areas of northern United States and in the Mississippi Valley. If a good yield of corn is to be produced on a soil which lacks sufficient humus to make it a loam, organic matter must be added in the form of stable manure or green manuring crops. Humus is essential to the production of large yields of corn because: (1) It contains all of the essential elements of plant food,—nitrogen, phosphorus, and potassium; (2) it produces an open structure of the soil and, as a result, a deeper and more elaborate root system is developed; (3) it increases the water-holding capacity of a soil.

DRAINAGE

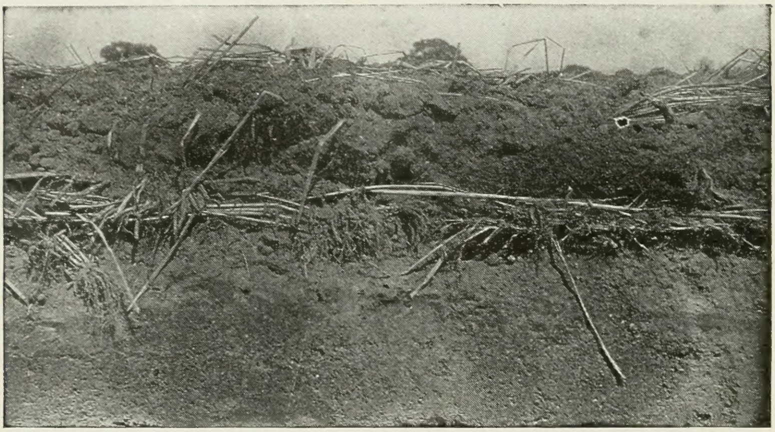
The soil must be well drained. If the water-table or water-saturated soil is near the surface during the month of May, the corn plant will spread its roots near the surface; when dry weather sets in and the water-table lowers, the roots will not have reached a depth which will enable them to secure sufficient moisture. The beneficial results of drainage are as follows:

(1) Drainage increases the amount of available moisture in the soil.

(2) Drainage is conducive to a deeper root development, which enables the plant the better to resist the summer droughts.

(3) Drainage permits the soil to become warm early in the spring, thus lengthening the growing season. Corn should not be planted when the ground is too cold to permit germination; drained land will become warm a week or two earlier than that which is undrained.

(4) Drainage allows air to enter the soil. Air is essential to the best root development; in fact, roots will not grow without it. Water escaping from the soil in drains tends to draw air down through the soil; this ventilation assists in making plant food available and in developing a good root system.



Moisture from below completely cut off by the plowing under of a heavy cover crop. This condition might have been avoided by earlier plowing or by cutting up the cover crop with a disk harrow before it was plowed under.

(5) Drainage is the first step in neutralizing an acid condition of the soil. If but a small quantity of acid is present, it may be completely washed out through the drains and the use of lime becomes unnecessary.

For these reasons, it is profitable to drain the wet places. An increase in crops will be certain to follow.

PREPARATION OF THE SOIL

The use of stable manure and the rotation of crops, including legumes, are the chief processes in keeping up the producing power of corn lands. When clover or grass is grown in a rotation, manure should be applied to this crop and plowed under for corn. There are several reasons why this should be done:

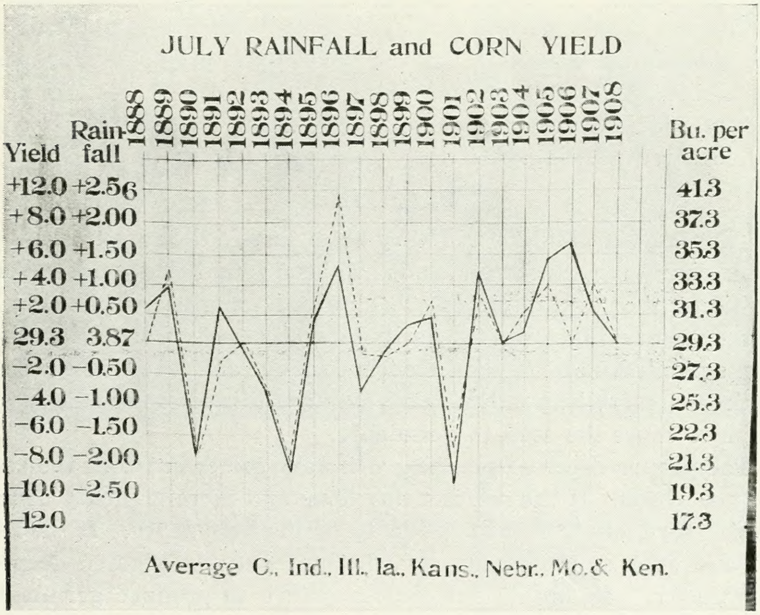
(1) The corn plant requires a large amount of humus because

this material increases the water-holding capacity and the supply of nitrogen in the soil.

(2) The corn plant is a gross feeder and can utilize fresh manure to a better advantage than any other plant can.

(3) The residue of manure left in the soil after the corn crop has been removed is a benefit to the wheat crop which follows.

(4) Corn is considered the money crop by most farmers in the corn belt; consequently, the greatest profit is made by applying manure to this crop.



Relation of corn yield to July rainfall. The dotted line represents the variation in the rainfall, while the solid line shows the corn production for the corresponding years. It will be noted that a high yield accompanies an abundant rainfall.

In many seasons water is undoubtedly the limiting factor in corn production. Professor J. W. Smith, of the United States Weather Bureau at Columbus, has found that the total yields of corn for the State of Ohio or for the corn belt may be predicted from the rainfall during the month of July. It has been found that in an average season an additional inch of rainfall retained in the soil during July means an increase of $5,000,000 in the value of the Ohio corn crop.

Unfortunately, rain does not always fall when it is most needed, but by proper tillage and cultivation, large quantities of moisture may be conserved until July. Winter, late fall, or early spring plowing, when conditions permit, is the first step in conserving moisture. Early plowing also destroys many insects injurious to corn and improves the mechanical condition of heavy soils. Freezing and thawing produces in clays the open structure which is so essential to plant growth.

Deep plowing for corn is profitable. The corn plant, under favorable conditions, will send its roots from four to six feet into the ground. The better the development of the root system, the larger the yields of corn. Six to seven-and-a-half inches is none too deep to plow for corn. However, not more than an inch of the sub-soil should be plowed up in one year.

The soil should be well prepared before the corn is planted. The grain should not be planted and the ground prepared afterwards, as is often done. A deep, fine, and compact seedbed will best retain the moisture. Moisture may be conserved by fining the surface as soon as possible after plowing.

PLANTING

The time for planting will vary according to the season and the location. In most northern states, it has been found that, under average conditions, the largest yields are obtained from early planting, the exact date varying with the latitude and seasonal conditions. The Indians planted maize ''when the leaves of the oak trees are the size of a squirrel's ears;'' when the oak leaves are this size, the soil is warm enough to cause the seed to germinate.

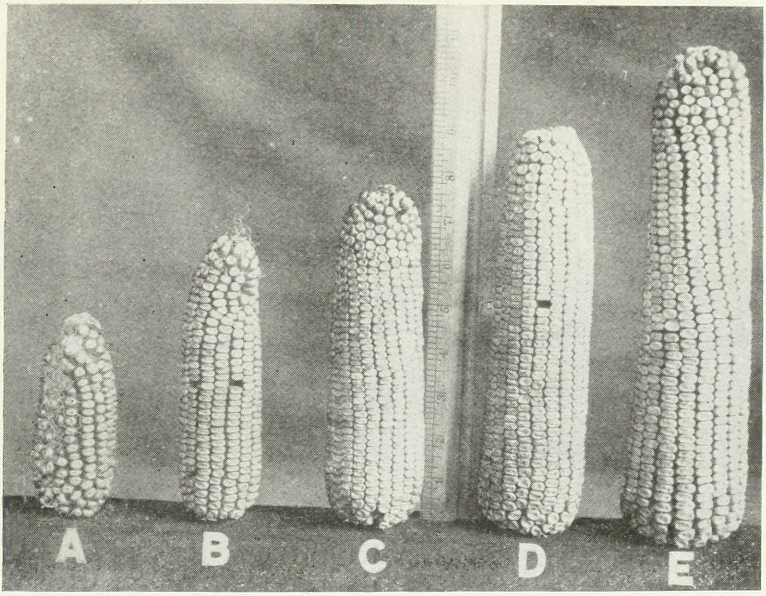
The proper depth of planting will vary somewhat with the season and type of soil. If the soil is a clay loam and there is plenty of available moisture, one inch will probably be the best depth. If the soil is light and open or the season dry, the seed must be planted deeper in order that it may obtain sufficient moisture to produce germination. At the College of Agriculture, Ohio State University, the best results have been obtained when corn was planted at a depth of about one-and-a-half inches. Deep planting produces a weak, undesirable plant because most of the plant food in the kernel is used before the young plant comes through the soil.

CULTIVATION

The principal objects of cultivation are:

(1) To conserve moisture.
(2) To kill weeds.
(3) To supply air to the soil and roots.
(4) To make plant food available.

Persistent, thorough, shallow cultivation pays. The prime object of cultivation is the conserving of moisture; if this be accomplished, weeds will cause little trouble. Shallow cultivation means stirring the soil to a depth of two or three inches. A dry mulch must be established or moisture will escape from the surface. Too shallow cultivation should be guarded against. When a three-inch mulch is compared with one of an inch or an inch-and-a-half, the former proves to be much more effective than the latter so far as the conserving of soil moisture is concerned. Professor F. H. King has found, by extended and repeated field trials, that there is invariably left in the soil at the end of the season a larger amount of water when the soil has been stirred to a depth of three inches than when it has been stirred to a shallower depth. The differences in a field of corn for one season are given below.



Comparative sizes of ears of different weights. D—A 1 pound ear. C—¾ pound ear. B—½ pound ear. A—Ear such as would produce with an 80 per cent stand, Ohio's ten-year average yield, 36.8 bu. per acre.

	Per Cent moisture in 1st foot	Per Cent moisture in 2nd foot	Per Cent moisture in 3rd foot	Per Cent moisture in 4th foot
Cultivated 3 inches deep........	23.14	23.30	21.94	22.46
Cultivated 1 inch deep..........	22.70	21.08	19.65	19.58
Gain for 3-inch cultivation..	.44	2.22	2.29	2.88

These differences at the end of the growing season represent 167.4

tons or 1.47 inches of water per acre in favor of the three-inch cultivation. This experiment furnishes proof that a three-inch mulch is more effective in conserving the moisture than a deeper or shallower one.

On the other hand, cultivation deeper than three inches not only causes greater evaporation but also cuts off from the plant a part of its food supply. In fact, the roots in the zone extending from three to six inches below the surface have a larger supply of plant food which is readily available than have the roots deeper in the soil. By cultivation, air is supplied to the soil; oxidation takes place rapidly and bacteria are induced to grow and multiply, consequently food is made available for the growing plant.

The conclusion from the foregoing facts is that the roots immediately below the zone of shallow cultivation should not be injured or destroyed.

Corn should receive cultivation until the ears are well developed. Later cultivation should be given to establish a dust mulch. The one-horse, spike-toothed cultivator is generally used for this purpose.

METHODS OF IMPROVING THE YIELD

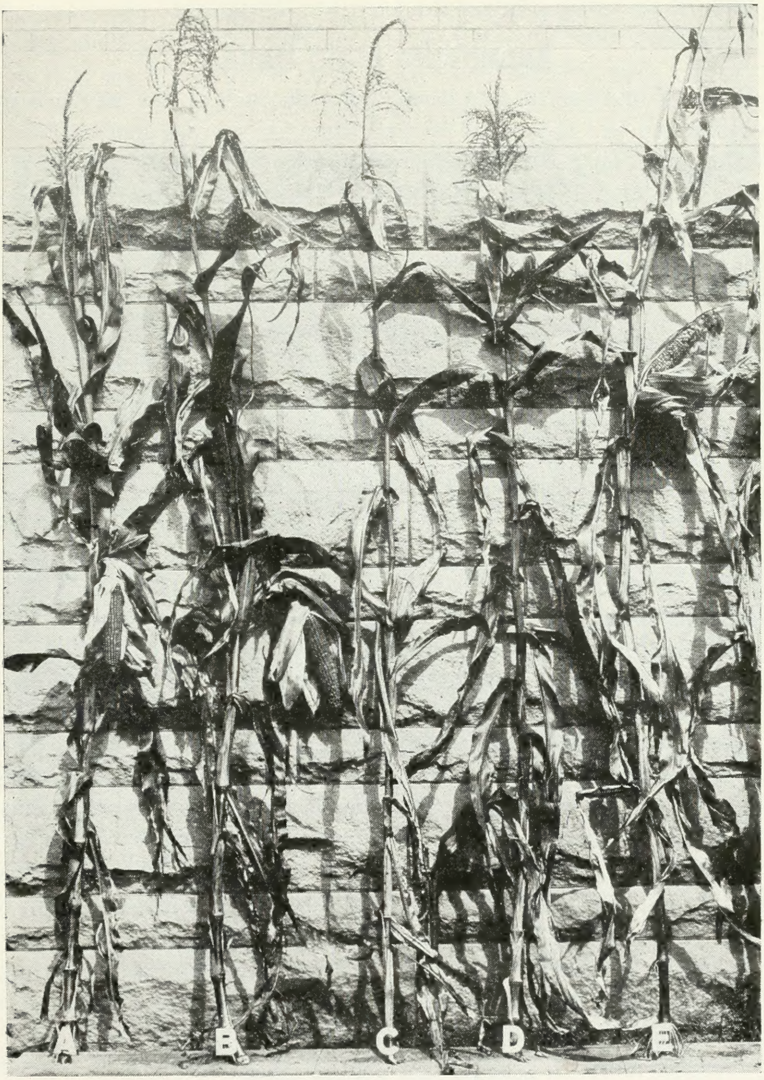
A simple corn variety test can be conducted with profit on every farm on which twenty-five or more acres of corn are grown. One will be surprised at the variation in the yields of different varieties in the same community. In order to systematically increase the yields, a variety proven to be adapted by test under local conditions should be chosen. If two rows of each of three or four varieties of corn, including the local variety, be planted side by side, the variety that will give the best results under existing conditions may be selected by observation and by the use of the scales at harvest time.

The best variety in the neighborhood may be planted and the best methods of cultivation practised, yet, if a good stand of plants is not obtained, there will doubtless be a low yield.

THE RELATION OF STAND TO YIELD

Hills, per acre, 3 ft. 6 in. apart	3,555
Number of stalks—3 stalks per hill	10,665
1 lb. ear to the stalk with perfect stand	152.4 bu.
1 lb. ear to the stalk with 80% stand	121.9 bu.
¾ lb. ear to the stalk with 80% stand	91.5 bu.
½ lb. ear to the stalk with 80% stand	60.9 bu.
4.8 oz. ear to the stalk with 80% stand	36.5 bu.

The average yield of corn in Ohio for the last ten years has been 36.8 bushels per acre. The table above shows that an 80% stand with a 4.8 oz. ear to the stalk will produce almost this yield. These figures plainly show the importance of a good stand. Failure to obtain a good stand may be due to neglect of the following:



A—A mature, vigorous plant with the ear at the right height, borne on a shank of proper length.
B—Ear borne at the end of a long shank, which is easily broken.
C—A weak plant.
D—A barren stalk.
E—Plant bearing ear too high. A late-maturing type.

(1) Proper method of selecting seed ears.
(2) Proper care of seed.
(3) Testing of seed ears.
(4) Preparing seed for planting.
(5) Regulating planter for accurate dropping.

SELECTING SEED EARS

When a breeder of live stock buys an animal, he attaches great importance to the record of its ancestry for several generations. In the selection of a seed ear, few even think of considering the merit of the parent plant. It has been proven advantageous to select seed ears from plants whose adaptability, environment, and characteristics are known. Large ears, which are often the result of favorable conditions in the field, do not usually produce well. Tests at the Ohio Experiment Station have proven this statement.

No. plants per hill the first year	Av. weight of ears the first year	Av. length of ears the first year	Yield the 2nd year, planted three stalks per hill
1	12 oz.	9.4 in.	91.5 bu. per acre.
3	10 oz.	8.8 in.	91.7 bu. per acre.
5	8 oz.	7.9 in.	92.6 bu. per acre

It will be noted that seed ears selected from the plot planted at the rate of five stalks to the hill averaged 8 oz., while those selected from the plot planted three stalks per hill weighed ten ounces. When planted the following season at the normal rate (three stalks per hill) the small ears produced 1.1 bu. more than the 10-oz. ears.

PLANT SELECTION

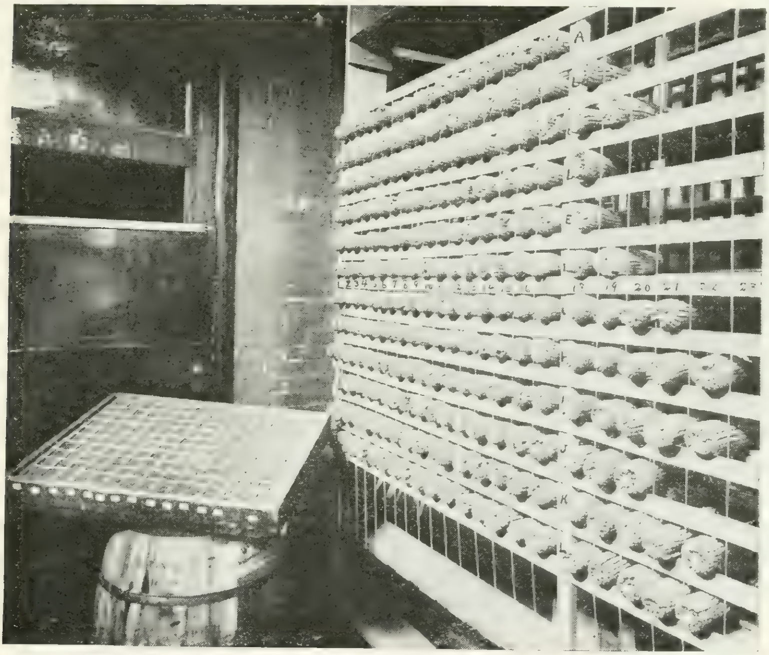
Plant selection of seed ears is the most profitable method by which the average farmer can improve his yield of corn. The best time to select seed corn is just before the crop is cut. The seed ears may be gathered at the time of selection or, better, they may be marked and left on the stalk until all of the corn is ready to husk. It is a good plan to break over the stalk above the ear selected and allow it to stand in the field until the ear is thoroughly matured.

In order to avoid the necessity for discarding many ears in the final selection, a part of the husk should be pulled from the underside of the ear and the general characteristics noted.

WHAT TO LOOK FOR

(1) If the ear is of good size, note should be made as to whether or not the plant is utilizing to the best advantage the full length of season and the particular type of soil.

(2) It should be noted whether the plant has an inherent tendency to produce a large ear or whether the size is due to advantageous conditions. The Experiment Station results given above show that large ears, grown under favorable conditions, are often comparatively poor producers. An ear must have an inherent ability to produce. If only one stalk grows in a hill where there should have been three, the ear on that stalk should not be selected even though it be mature, large, and symmetrical. A smaller ear, produced under normal or even poor conditions is likely to produce a larger yield when planted the next year under normal conditions.



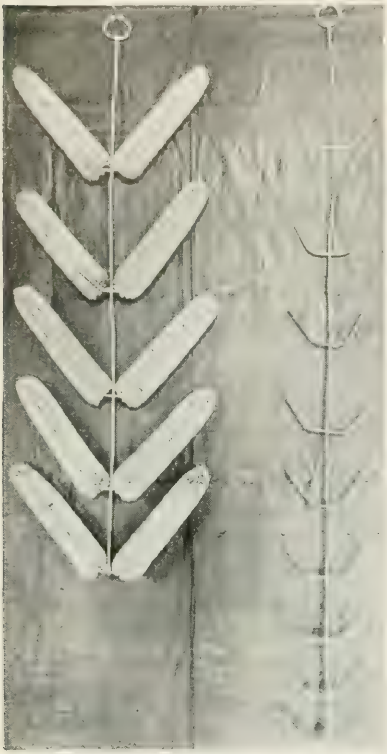
Rack for storing seed ears. See Page 12. Free circulation of air around each ear. A partly-filled germinator in the foreground.

(3) Ears growing slightly below the middle of the stalk or within easy reach of the husker should be selected. The plant with a low-set ear is more storm-resisting than one with the ear set high.

(4) Ears having shanks of the proper length and size should be selected. An ear should be slightly inclined, since this position affords protection from rain, birds, and insects. An upright position of the ear indicates a large shank and cob with shallow kernels, which are undesirable characteristics.

(5) A vigorous plant with large leaf surface is to be desired.

The leaves may be likened to a factory, where crude materials are made into the finished products. The products of this action in the leaves are transferred to the growing parts of the plant or stored up in the ear for future use. It is probable that in a humid climate an enlargement of the leaf area increases the yields to some extent.



A stay of the electric weld fence used for hanging seed ears.

If seed corn is selected with the foregoing points in mind, one man can selected four or five bushels per day.

The Ohio Experiment Station has conducted an experiment showing that "plant selection" of seed corn produces an average of 3.23 bushels per acre more than does selection from the wagon at husking time.

Figuring the increased yield per acre that may be expected, one must conclude that plant selection is a profitable as well as a practical method of selecting seed ears.

CARE OF SEED

There are three things to be remembered in storing seed corn properly:

(1) The seed ears should be thoroughly dried before freezing weather.

(2) The seed ears should be stored in a dry, well ventilated room or building.

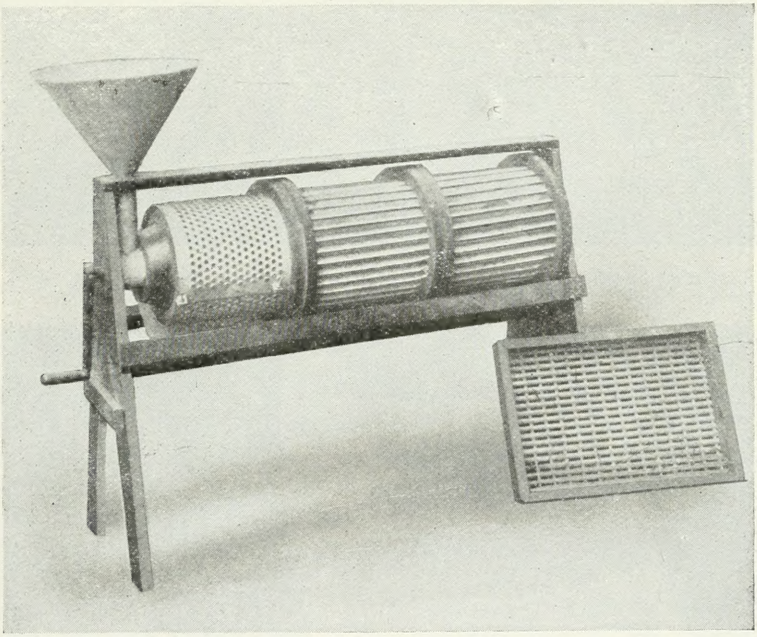
(3) The seed ears should be stored so as to permit perfect ventilation about each one.

If the above suggestions are observed, the exact method of storing will be immaterial. Racks made by using 6′x6″x1″ boards as uprights, with plastering laths nailed on opposite edges of the uprights so as to form shelves about four inches apart, provide at small cost a very desirable place for storing seed ears.

TESTING OF SEED CORN

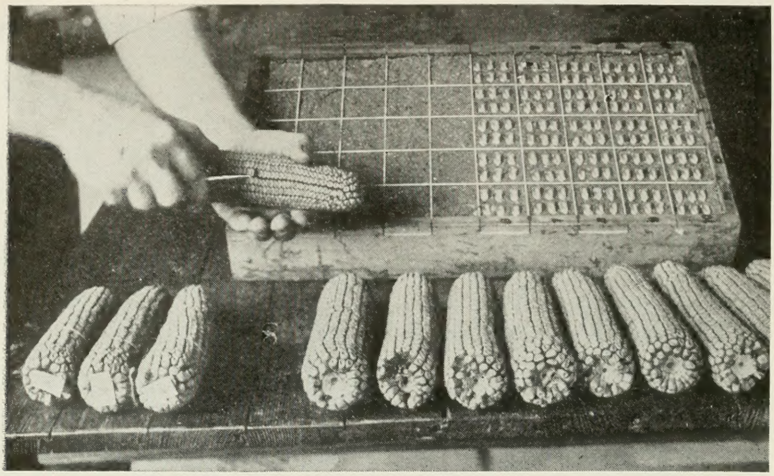
Although great care may have been taken in the selection and storing of seed corn, one will secure the best results by testing each ear in the spring to make sure that it will grow. There are about 900 kernels on the average ear. If, out of every hundred ears planted, four or five lack vitality, it will mean at least 2,000 fewer stalks in the field per 100 seed ears planted.

Page 14 shows a hand-made germinator that has proven very satisfactory. A germinator 30x20x3 inches inside measure is very convenient. Notches one inch deep should be sawed every two inches along the sides and ends of the box, numbers from 1 to 15 placed between the notches on the sides, and letters from A to U on the ends. Two inches of damp sand, sawdust, or soil should be placed in the box, which is then separated into two-inch squares by a string passed forward and backward through the notches on sides and ends of the box; each square will have a separate number.

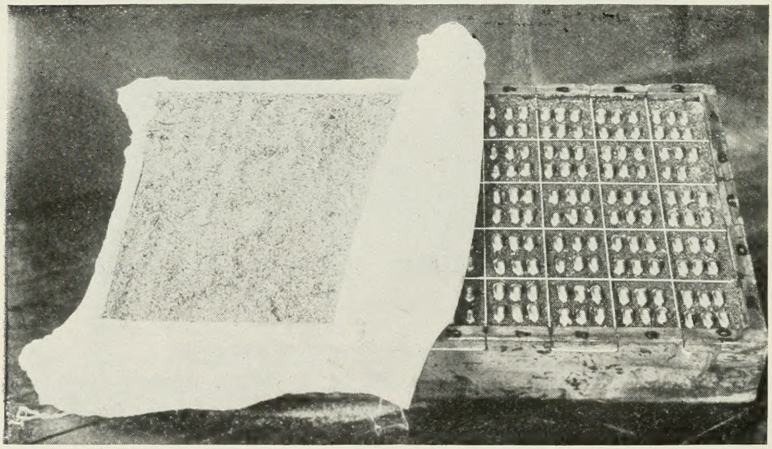


Two types of corn grader, rotary and sieve.

Six kernels from each ear should be tested. The one making the selection should take a kernel near the tip, turn the ear one-sixth around and take a kernel in the middle, turn one-sixth again and take another near the butt, turn another sixth and repeat the process. Such a test will determine the seed condition at all locations on the ear. The six kernels are placed in one of the squares. The number of the square is then placed on a small piece of ordinary paper or cardboard and this tag pinned to the butt of the ear. When the box is filled, a cotton cloth should be laid evenly over the kernels and another inch of damp sand, sawdust, or soil placed on top of the cloth.



Method of lifting kernels from the the ear preparatory to making test. Three ears on the left marked as described.



A convenient box germinator. A sure method for detecting dead ears.

In conducting such a test, it is very essential that the germinator be placed as nearly as possible under FIELD CONDITIONS. A temperature of 50 or 60° Fahrenheit in a building will correspond to the temperature of the soil at planting time. After a week or ten days, the cloth may be rolled back and the kernels examined. Any ear which has failed to germinate perfectly should be discarded.

PREPARATION OF THE SEED FOR PLANTING.

It is best to shell seed corn by hand. The tip and butt grains should be discarded, since uniformity in shape and size of kernels is necessary for accurate work of the planter. The planter should be adjusted to each grade or size of kernels to insure an even stand in the field, since this is one of the most important factors in producing a large yield.

SUMMARY

Drainage and humus are necessary for the production of large yields of corn.

Available moisture is the prime essential of a high yield.

The seedbed should be deep and well-prepared.

Uniform, shallow planting gives the best results.

Persistent, thorough, shallow cultivation pays.

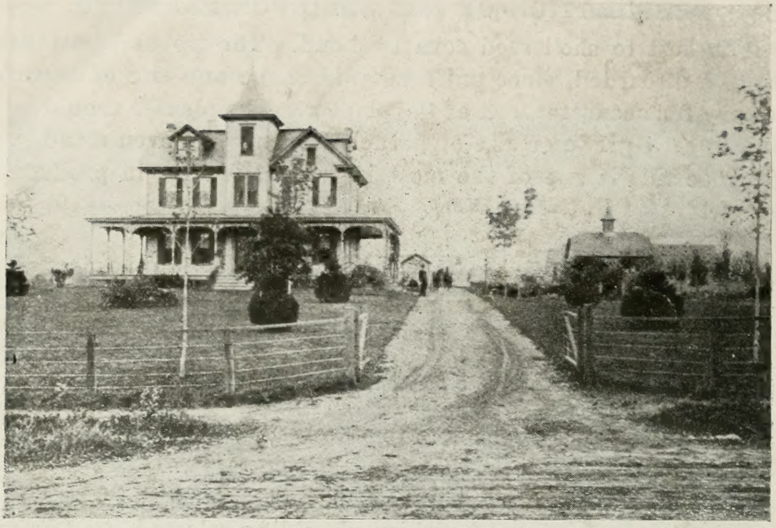
A home variety, adapted to the soil and the length of season and proven by test to be a good yielder, should be selected.

Field selection of seed corn is more profitable than selection from the wagon at husking time or from the crib.

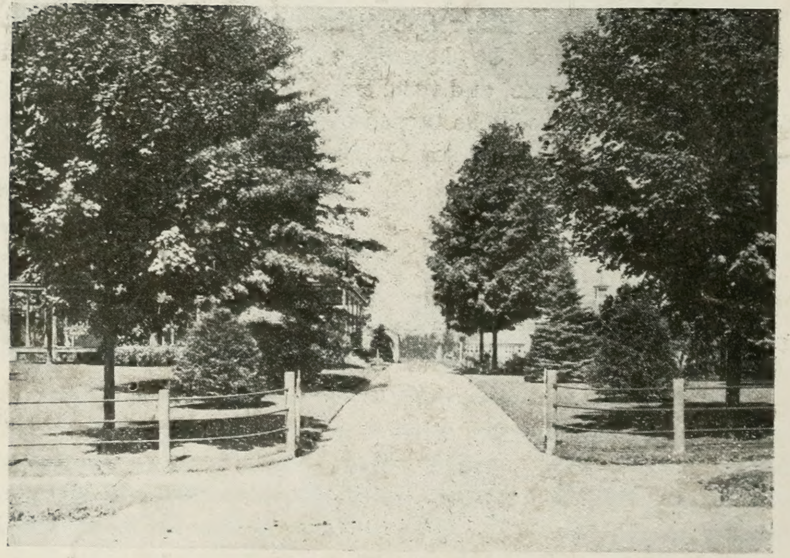
Proper attention to the storage, testing, and grading of seed corn will tend to assure a good stand.

ANNOUNCEMENT

The Eight Week Summer School in agriculture and horticulture at the Ohio State University, beginning June 17, will include courses for farmers, business men, and teachers. The entire equipment of the College of Agriculture will be turned over to specialists who will conduct the work. A. B. GRAHAM, Supt. Agricultural Extension.



Country residence soon after planting.



Same residence ten years after.